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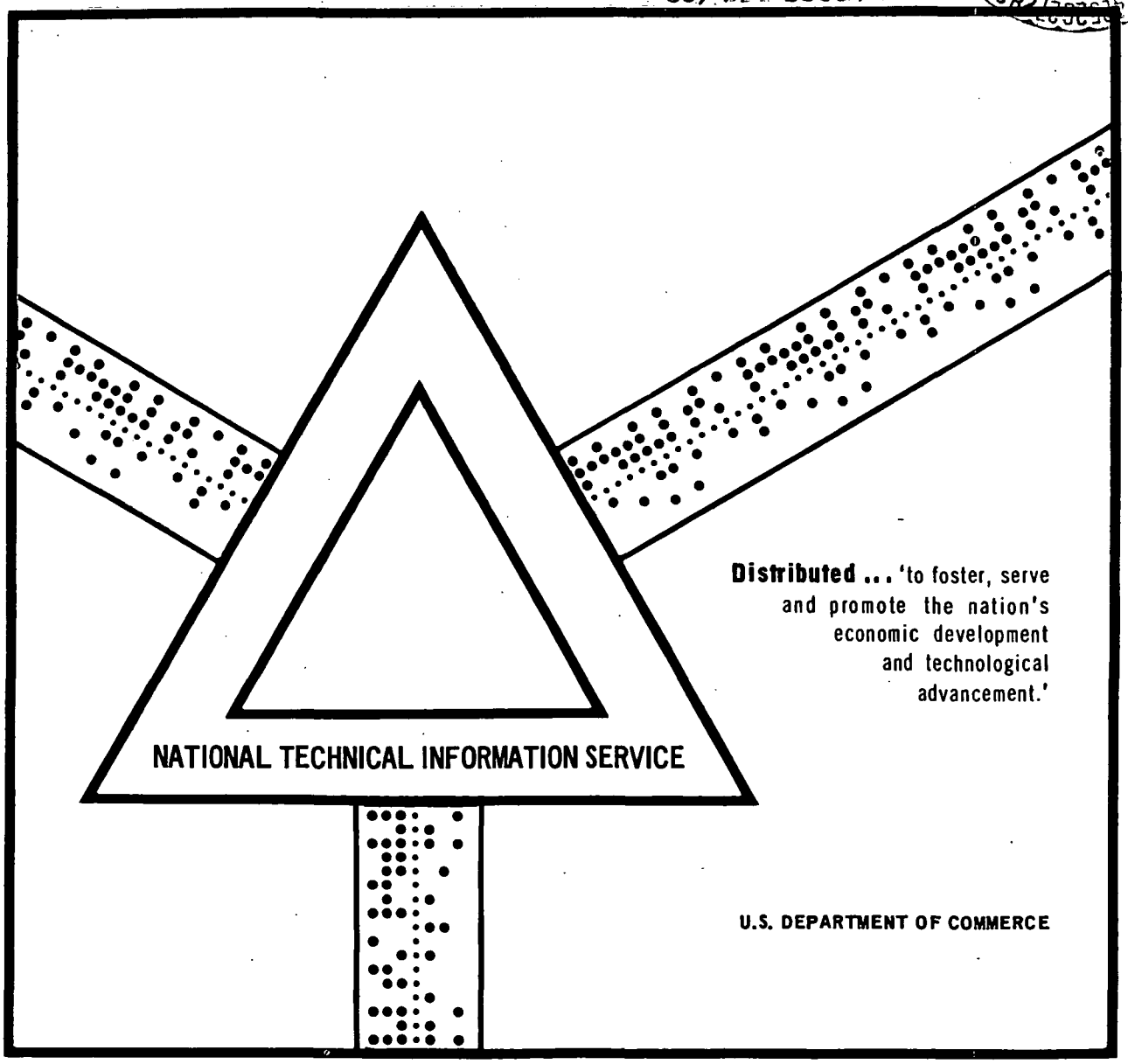

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ENVIRONMENTAL IMPACT STATEMENT
FOR
LANGLEY RESEARCH CENTER

Hampton, Virginia

August 1971

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SUMMARY OF STATEMENT

Final Environmental Impact Statement
Langley Research Center
Hampton, Virginia

1. Name of Action: (Check one) (X) Administrative Action
( ) Legislative Action

2. Brief description of action indicating what states (and counties) particularly affected.

Langley Research Center is located within the City of Hampton, Virginia, and adjacent to York County, Virginia. This impact statement is an evaluation of an existing installation which has been in operation for over 50 years.

3. Summary of environmental impact and adverse environmental effects.

Appraisal of various operations and functions at Langley Research Center reveals that there are three principal sources of concern with respect to adverse environmental effects. They are:

a. Heating-plant emissions and blowdown effluents.

b. Cooling tower chromates in blowdown effluent.

c. Brief periods of noise produced by wind tunnels.

The effects of a. and b. are confined to the Center. Funds have been requested to modify these facilities so that emissions and effluents will be within the levels established by published guidelines. The effect of tunnel noise is mitigated to some extent by distance from adjacent communities.

4. List alternatives considered.

Not applicable to an established existing research center that has a value in land and facilities in excess of $250 million.

5. List all Federal, State, and local agencies and other sources from which written comments have been received.

Written comments were received from the Council for Environmental Quality. The impact statement was revised to conform to the recommendations contained in the comments.

6. Date draft statement and final statement made available to Council of Environmental Quality and public.

The draft statement was made available to CEQ and the public on or about March 2, 1971.

The final statement should be available to the public and CEQ on or before August 30, 1971.

SECTION I

INTRODUCTION

This institutional environmental impact statement for the Langley Research Center is prepared in compliance with NASA Management Instruction (NMI) 8800.7A, "Guidelines for the Preparation of Environmental Statements Required by the National Environmental Policy Act of 1969." In this report we describe the potential sources of pollution at Langley Research Center and our methods of eliminating or minimizing their effect on the environment. Generally, these potential sources may be broadly categorized as noise, chemical, gaseous, and particle emissions into the atmosphere or surrounding water.

The Langley Research Center is described, together with the nature of its activities, from which it can be seen that the Center is basically not a major pollution source. Geographical, geological, and climatic characteristics of the site are also described, inasmuch as they influence both the choice of disposal methods and the environmental effects of the pollutants.

The document describes as quantitatively as possible the known or probable pollution sources at the Center. Where the intensities (or concentrations, etc.) of these sources might exceed the recommended guidelines, the corrective actions that have been taken or are being taken are described. The entire inventory of pollution sources and control methods is summarized in an appendix.

The coordination of our pollution-control activities with those of Federal, State, and local agencies is also reviewed, together with various other related items that were requested in the above-mentioned Management Instruction.

It will be apparent from the document that while, as already noted, the Langley Research Center is not the type of installation that contributes very significantly to pollution of the environment, it is applying all reasonable effort to control its pollution sources and maintain them within the limits recommended by the guidelines.

SECTION II

MISSION

The Langley Research Center conducts a comprehensive range of research programs to identify and evaluate new opportunities for advanced aeronautical and space flight activities; to expose and solve the basic technical problems confronting flight progress; to evolve, improve, and validate the technological basis for the design, construction, and operation of advanced aircraft and space vehicles; to support the conduct of nationally important flight projects; and to promote the broad diffusion and application of aerospace research knowledge.

A significant portion of the Langley research program is directed to developing, evaluating, and refining specific aircraft designs and to exploring and understanding improved concepts and technology on which future aircraft with more advanced performance, increased operational capabilities, and enhanced safety and economy may be based. In this effort, special emphasis is placed on the evolution of aircraft configurations which maximize flight efficiency, as in the Langley supercritical wing development for high-subsonic-speed transports, variable-sweep-wing and optimized-integrated-design approaches for supersonic military and civil aircraft, and the study of improved concepts for ramjet-propelled hypersonic vehicles and V/STOL aircraft designs. Associated research is aimed at the prediction of critical operating loads and aeroelastic characteristics of advanced designs,

and the evolution of new materials and structural concepts with improved efficiency under critical environments. Related programs are providing insight into the stability and control problems of new generations of vehicles, and particularly those associated with all-weather and terminal-area operations, cooperative or competitive maneuvering, and other complex flight tasks. Studies are also under way on the technology for detecting clear-air turbulence and aircraft trailing vortices; on simplified lower cost approaches to collision-hazard warning systems; and on integrated and automated controls for light aircraft. Considerable work is under way investigating the basic causes of aircraft propulsion noise and sonic boom, the characterization of their annoyance effects, and the study of practicable methods for noise reduction. Advances being accomplished in the study of tire, braking system, and runway surface design requirements for improved aircraft traction and control on water- and slush-covered runways are finding important applications in the automotive safety field. The technical support of the Air Force, the Navy, the Army, the Federal Aviation Administration, and the aerospace industry is a continuing portion of the Langley program.

Another significant portion of Langley's skills and resources is devoted to advancing the Nation's space flight capabilities, and to the management and support of important space flight projects. Especially noteworthy are research efforts relative to atmosphere-entry aerothermodynamics and heat shielding for return from earth-orbital, lunar, and planetary missions; the structural dynamic

characteri s of large launch vehicles and complex modular spacecraft; advanced configurations for lifting-entry and controlled-landing spacecraft, refurbishable space vehicles, a long-duration orbital and planetary systems, and expandable space structures; the effects of heat, vacuum, loads, noise, micrometeoroids, and radiation on the performance of vehicle systems and materials; the technology of improved electronic, propulsion, information, structures, and life support systems; and man's functional capabilities and systems accommodations for performance of complex manned space missions involving space assembly and maintenance, rendezvous and docking, extravehicular operations, and extraterrestrial landings.

Because of its broad space research experience and flight project success, Langley has been assigned responsibility for the Viking Project, which plans to orbit and soft land unmanned instrumented vehicles on Mars in 1976 for study of Martian geophysics, atmospheric characteristics, local surface properties, and life-form indicators. Langley is also prominently engaged in the definition and provision of advanced technology required for the selection and development of manned systems and operations for future national space shuttle, space station, space base, and planetary mission projects. This includes investigations of mission flight mechanics and operations; configuration performance and aerothermal characteristics; structural efficiency, aeroelasticity, dynamics, and thermal protection; the technology of practicable navigation, guidance, control, power, propulsion, information, tracking, communications, and long-duration life support systems; criteria for

human factors and crew activities; and the definition, development, and integration of worthy mission experiments. Langley is also responsible for the development and operation of the Scout launch vehicle in its various national and international satellite and entry vehicle applications; for the provision of ranges of technology and experiments for the continuing phases of the Apollo lunar and applications programs; and for broad technological support of a number of other space flight projects.

SECTION III

DESCRIPTION OF CENTER

Location. Located approximately 100 air miles south of Washington, D.C., Langley Research Center is adjacent to the runway facilities of Langley Air Force Base and within the political subdivision of the City of Hampton, Virginia. Geographically, the Center can be described as near the southern extremity of the lower Virginia Peninsula (Lat. 37° - 5' N; Long. 76° - 21' W), and between the northwest and southwest branches of Back River, a tidal estuary of Chesapeake Bay.

Land Area - Real Estate. The Center occupies 773 acres of Government-owned land, divided into two areas by the runway facilities of Langley Air Force Base. The West Area consists of 750 acres, 430 owned by NASA and 320 under permit from the Air Force. The East Area comprises 23 acres under Air Force permit. Runways, some utilities, and certain other facilities are used jointly by NASA and the Air Force. In addition, there are 110 acres of NASA-owned land located in the City of Newport News, Virginia, 3,277 acres under permit from other Government agencies and 9 acres under lease. The total acreage presently owned, under permit, or leased is 4,169.

Langley Research Center comprises 219 buildings and structures located in the two major areas which are approximately 4 miles apart. The East Area contains 22 facilities and is located entirely within the confines of Langley Air Force Base. Most of the East Area

structures are major wind tunnels with their supporting facilities, the balance being administrative and project office space. The West Area is the major portion of the Center. The buildings are generally two to three stories, of permanent construction of brick, concrete, and masonry block, and are well maintained. Streets are paved, gently curving, and bordered in many stretches with shade trees so that this area of the Center presents an eye-pleasing appearance.

History and Growth. Langley Research Center had its early beginnings in 1917 when the War Department purchased land in Elizabeth City County, now Hampton, Virginia. It was procured for the joint use of the Army and the National Advisory Committee for Aeronautics (NACA), the forerunner of the National Aeronautics and Space Administration. The new base was named Langley Field. On June 11, 1920, the Advisory Committee for NACA conducted exercises at the new field dedicating NACA's first wind tunnel and the laboratory, which was officially designated as the "Langley Memorial Aeronautical Laboratory." Until the beginning of World War II, the growth of Langley was relatively slow.

The exigencies of war created urgent demands for increasingly faster and more effective military aircraft. The resulting rapid expansion of research facilities at Langley brought forth startling developments so that by the end of World War II new turbojet and rocket engines made possible unmanned flight in the upper atmosphere at supersonic speeds. Successful research launched the United States into the Space Age and contributed greatly to the growth of Langley.

In response, Congress in 1958 passed the "National Aeronautics and Space Act" which terminated NACA and marked the beginning of the

"National Aeronautics and Space Administration." NACA, with the excellent laboratories of Langley and three other installations, became the nucleus of the new civilian agency to be known as NASA. NACA's "Langley Laboratory" then for the first time became officially designated as "The Langley Research Center of the National Aeronautics and Space Administration."

Community Information. Hampton, including Langley Research Center and Langley Air Force Base, is an integral economic and social component of the Newport News-Hampton Area. The metropolitan population totaled approximately 280,000 persons in 1970.

Zoning Regulations. Because of its relative isolation from populated areas of metropolitan Hampton-Newport News, no local zoning regulations appreciably affect the development or operation of the Center. A height limitation has been agreed upon between NASA and the Air Force to restrict structures to 250 feet in height, outside the normal runway clearance criteria.

Coordination with Communities. Close and continued liaison has been maintained by the Center's management with the Air Force, the cities of Hampton and Newport News, and with York County to bring about necessary decisions for capital improvement programs affecting traffic and transportation, adjacent land use, off-base utilities, and cultural and recreational facilities.

Geology and Meteorology

Geology. Langley Research Center is located in the Atlantic Coastal Plains' physiographical Province of Virginia. The coastal plain consists of a series of marine and nonmarine terrace deposits that step up in elevation, from east to west, from sea level to about 300 feet at the western extremity of the Province.

Langley is situated on an emerged marine terrace plain of Pleistocene Age. The coastal plain in the subject area is underlaid by sedimentary formations composed of sand, silt, clay, marl, diatomaceous earth, and gravel which range in age from early Cretaceous to recent. These materials are, for the most part, unconsolidated or only partly consolidated, but in certain of the formations, indurated layers are interbedded with the softer materials. These Sedimentary Beds, as a whole, form a wedge-shaped mass which thickens to the southeast. The aggregate thickness of this sedimentary bed in the subject area is about 2,500 feet and rests on crystalline rock. The surface formation in the Langley Research Center area is Talbot, which consists of layers of medium dense sand, clay, gravel, and silt that may have a thickness of 40 to 50 feet. Beds of marine or brackish water, shells, cypress stumps, and other plant remains may also exist within the formations.

Soil Conditions. Soil in the area is sand, mixed with varying amounts of clay. The surface is deposited loam from 2 to 6 feet in depth. Heavy structures require pile foundations and new pavements require extensive subgrade preparation.

Climate. The promimity of Langley and the general Newport News-Hampton area to the Atlantic Ocean provides the peninsula with a mild year-round climate. The annual mean temperature is 60°; the warmest month being July, with an average temperature of 78.8°. The coldest month, January, has an average temperature of 41.9°. Extreme cold waves seldom penetrate the area; a recording of zero has never been recorded by officials since records were begun 90 years ago, and snowfall is light.

Records of the United States Weather Bureau show that winds are of moderately high velocity with north-northwest winds prevalent during October, November, and December, and south-southwest winds prevalent during April, May, and June. The annual precipitation averages 42.9 inches. July, normally, has the greatest amount of rainfall, with an average of 6.50 inches. Relative humidity, maximum 100 percent, minimum 39 percent; snowfall, annual average 8.6 inches with a maximum of 4.4 inches in a 24-hour period. Winds of hurricane velocity are not of normal frequency, but every 2 or 3 years during the months of August and September there is the possibility of a hurricane originating in the Caribbean area, reaching as far as the Middle Atlantic States or beyond in its northwest course. Several times in the past 50 years, this course has included the general Norfolk area. Winds of 80 to 100 miles have been recorded, together with 8- to 10-foot tides. Langley Research Center, however, with a 13-foot elevation, has not been inundated except for a few facilities in the East Area.

SECTION IV

ENVIRONMENTAL IMPACT

1. Description of the Langley Research Center Operations With Potential to Affect the Environment

Electricity. Langley's electrical power is served from the Peninsula Substation for the Virginia Electric and Power Company by two 500 MCM copper overhead transmission lines operating at 110 kV, each protected by a 240 MVA circuit breaker at the substation. Provision is made in the design of the VEPCO system and of the Langley system for the eventual addition of a third 110 kV feeder, when and if needed.

Steam Generating Plant. The Langley Research Center West Area heating plant contains five steam boilers which provide steam for operating research equipment and for utility heating purposes.

Number 6 fuel oil of the lowest sulfur-content fuel that is reasonably available is consumed at an average rate of 500 gallons per hour. Smoke densities discharged from the stacks during normal operations are within the limitations published in the Federal Register, Vol. 31, No. 107, titled "Prevention, Control, and Abatement of Air Pollution From Federal Government Activities: Performance Standards and Techniques of Measurement."

National primary and secondary ambient air quality standards, published in the Federal Register, Vol. 36, No. 84, dated April 30, 1971, however, are exceeded by this facility. Initial calculations show

concentrations of sulfur dioxide to be 5,000 $\mu g/m^3$ and particulate matter to be 180 $\mu g/m^3$ over an averaging time of 1 hour. The solution to this problem involves the substitution of natural gas for fuel oil, and the modification of the heating plant stack to permit adequate dispersion of the effluent gases.

Blowdown of the boilers discharges approximately 2.5 million gallons of waste water per month. This water has a high alkalinity and large solids content because of treatment with chemicals to protect the boilers. The possibility of discharging this water into the municipal sewerage system will be explored. It presently is dumped into the storm sewer system.

Environmental control projects included in the FY 73 C of F budget will materially improve this facility if funding is approved for construction projects requested.

Water - Source of Supply. Langley Research Center does not have an independent source of water, but shares a common source with Langley Air Force Base and Fort Monroe from an impounding reservoir, purification plant, and pumping station located on a Government reservation at Big Bethel Reservoir. Three parallel transmission mains deliver water to Langley Air Force Base. From there, two transmission mains, traversing slightly different routes, deliver water to Fort Monroe. Elevated storage is provided at both locations, 12,500,000 gallons being provided at Langley Research Center/Langley Air Force Base and 750,000 gallons at Fort Monroe. The entire system is United States Government-owned and U.S. Army-operated.

The reservoir has an 8-square-mile watershed which will yield a flow of sufficient capacity to satisfy the requirement of the system only during periods of average or greater than average rainfall. During periods of less than average rainfall, it has been necessary to supplement the raw water supply by purchase from the City of Newport News.

Sanitary Sewer System. Sanitary sewer system effluent from Langley Research Center is deposited into the Hampton Roads Sanitation District Commission system. All sewage in this system is treated and processed to a degree which meets all applicable Federal and State laws.

There are several facilities which have waste systems that for various reasons are not connected to the central sanitary sewage system. These facility drain systems are operated as follows:

Building 1258, Landing Loads Compressor Building, and Building 1199, Maintenance Building, have septic tanks with drain fields. Building 1258 is being converted to holding tank operation, and Building 1199 will be connected to the sewer by means of a pumping lift station.

Building 1150 in the West Area and Building 720-A in the East Area have glue pots in the Model Finishing Shops. The residue from the glue pots' traps is pumped out by the septic tank pumping trucks approximately once a month. The water effluent is drained to the sanitary sewer system.

Building 1213, West Cafeteria, and Building 1222, Morale Activities Building, have grease traps provided in the kitchen drains to the sanitary sewer system. The grease traps in the Cafeteria drains are pumped out about every 2 weeks and those in the Activities Building drain about once a month.

The underground utilities tunnels have sumps to collect drainage from the steam and condensate from the air used to operate the pumps. The oil that settles out in the sumps of the underground utility tunnels is pumped out annually by the septic tank pump trucks and the water effluent is directed to the storm sewer system.

Waste Disposal

Trash. Disposal of trash at Langley Research Center is accomplished by the following methods:

Normal Refuse. Normal refuse includes paper, floor sweepings, and similar general trash. It is collected in 6-cubic-yard containers (Dempster Dumpmaster type) and then transported by hydraulic packer-type equipment to an on-base sanitary land fill area for disposal. (Approximately 48 cubic yards per working day.) Services for this operation are provided under a contract which also includes similar services for Langley Air Force Base, Fort Monroe (U.S. Army), and Fort Eustis (U.S. Army). The contract is issued by the Langley Air

Force Base with prorata funds furnished by the four Government agencies serviced. The on-base sanitary fill area is located in the northwesterly part of Langley Air Force Base between the Air Force Ordnance Storage Facility and the NASA Storage Area.

Wet Garbage. Wet garbage in the amount of 500 lb per working day is removed from the Langley Research Center cafeteria kitchens by a livestock producer for animal feed.

Scrap Metals. Excess materials and equipment having reclaim value are transported to the U.S. Navy Cheatham Annex in Yorktown, Virginia.

Scrap Materials. Small quantities of scrap materials such as building materials, bricks, tree and shrub trimmings, and broken concrete are transported to an open land fill. This is located at the Center in low-elevation areas on the north side of the NASA Landing Loads Track.

Chemical Waste. Where the material is either flammable, toxic, or hazardous, specialized disposal methods are employed to reduce the harmful effects to property, environment, and human life. Chemical wastes at Langley that are harmful and require specialized disposal methods fall into two basic categories: (1) regularly used items

requiring periodic disposal such as used lubricating oil and paint thinner in the amount of approximately 20 barrels per month, and (2) rarely used, special purpose materials ranging from laboratory samples, sometimes of unknown chemical composition, to a 55-gallon drum of hydrazine. Items in category (1) represent almost the total disposal volume, while category (2) items provide the bulk of the disposal problems.

The responsibility for properly disposing of waste chemicals rests with each individual user or custodian. Langley's Safety Office does, however, provide both consultation and disposal services for any chemical waste that needs special treatment. The disposal methods either neutralize or reduce the chemical to its basic constituents.

In the past it was established practice to dispose of a majority of the harmful chemical wastes by controlled open burning or by burial. Neither of these solutions was considered to be acceptable and an investigation was conducted to determine the most practical and economical method having the least impact on the environment. As a result of the study, it was recommended that a high-temperature liquid waste incinerator be purchased and installed. This

was accomplished in early February 1971. Most of the material requiring specialized disposal will now be incinerated. In its first trial operation, the incinerator yielded no smoke, no odor, and no visible ash. There is no secondary material created for disposal.

For the chemical waste not suitable for incineration, it was recommended that a contract disposal service be employed. The Safety Officer is currently investigating contract sources. Pending the award of a disposal contract, waste is stored in the chemical magazine storage area. This area was specifically designed and constructed to provide storage for hazardous chemicals.

Several other actions have also been taken at Langley as precautionary measures to reduce the possibility of pollution.

1. Catch basins were included in the design and construction of Buildings 1164, Nitrogen Tetroxide Magazine; 1156, Hydrazine Magazine; and 1157, Hydrogen Peroxide Magazine, to permit waste material to be diluted, neutralized, or decomposed prior to release into the sewer system.

2. Waste water containing the processing chemicals from the Photo Laboratory, which is discarded into the sanitary sewer, has been analyzed. It has been determined that a pollution problem is not created by this effluent.

3. Old photographic film once disposed of by burning is now sold as surplus to firms which recover the silver.

Radioactive Waste. The control and disposal of radioactive wastes is regulated by Code of Federal Regulation, Title 10 (CFR - Title 10) - Atomic Energy, and law. In the past, some potentially contaminated liquids (a few microcuries per year) were diluted with water until the resulting mixture was within the AEC allowable limits and then released to the sanitary sewer system. Other liquids, again in very small quantities, were stored in AEC (CFR - Title 10) approved containers and disposed of by a contractor using approved methods. In the future, liquids will be evaporated and the solids remaining will be disposed of as solid wastes.

Solid waste, consisting for the most part of thoriated metals (2 to 4 percent thorium) with a dosage rate of approximately 0.1 mr/hr and amounting to under 25 lb per year, is packaged in AEC (CFR - Title 10) approved containers and stored in an isolated building which is surrounded by a protective fence. The fence is posted with signs marked with approved radiation symbols. Periodic monitoring and radiation readings are made of the storage area. At appropriate intervals the waste is disposed of by means of an AEC licensed contractor.

At the Space Radiation Effects Laboratory, a weekly health physics survey is made to check water, air, and area radiation levels. Except for that produced by small quantities of radioactive materials used for instrument calibration, radiation is produced by the operation of the cyclotron which is enclosed in a shielded vault.

A Subcommittee on Radiation Safety reviews and initiates recommendations concerning the radiation control program at Langley Research Center. The chairman of this committee is the certifying officer for all AEC licenses. The Subcommittee on Radiation Safety reports to the Chairman of the Executive Safety Committee.

Storm Sewer System. The storm sewer system functions to carry water from facilities, streets, and parking areas to the surrounding rivers and creeks and thence to the Chesapeake Bay. The East Area system at Langley Research Center collects the drainage from that area and empties it to the Southwest Branch of Back River (Enc. 1, Appendix A). The West Area system is made up of approximately six systems which collect the drainage and empties it to Brick Kiln Creek or Tabbs Creek (Enc. 2, Appendix A).

An investigation made in 1965 (reported in Investigation of Waste Disposal Practices at Federal Installations by the U.S. Department of Health, Education, and Welfare, September 27, 1965) and subsequent investigations conducted by Langley Research Center personnel indicated that no significant contamination of the storm sewer effluent originated from surface water or from the small amount of subsurface water in the storm sewer effluent. Therefore, continuing efforts toward eliminating storm water contamination have been focused on finding ways to prevent the introduction of contamination from facility drains.

The principal environmental concern with respect to the storm sewer system is blowdown from 73 cooling towers. Chromates are used as corrosion inhibitors for the water which is recirculated through the cooling tower system. The water in 22 cooling towers is maintained at an average of 192 ppm of Betz Laboratories Dianodic No. 139.

The chemical composition of this product is approximately 45 percent $Na_3PO_4 \cdot H_2O$ and 55 percent $Na_2CrO_4 \cdot H_2O$. Samples of water from storm sewer outfall reveal chromate concentrations as high as 15 ppm.

Other sources which introduce small quantities include the following:

Chemicals from chemistry and photographic laboratory drains.

Oil from machinery drains and hydraulic system leakage to flow drains.

Chemical from drains in laboratories for materials processing, such as plastics, coatings, forming and bonding, electroplating, and cleaning.

Paint from paint spray booths.

The FY 73 C of F budget contains a request for funds to install automatic control equipment on all towers having flow rates of 500 gpm or higher. This equipment will materially reduce the quantities of treated water discharged into the storm sewer systems. Funds to construct an experimental skimming basin have also been requested. It will be used to concentrate, identify, and quantify types of pollutants at a major storm sewer outfall. The information obtained will be used to arrive at a permanent solution to the problem.

A change in chemical treatment of the cooling towers is also being investigated. Before a final decision can be made, the corrosion inhibiting qualities will have to be confirmed, and the toxicity established.

Research Facilities

Appendix B lists the Langley Research Center research facilities, together with their possible contribution to pollution. This listing represents only an initial survey. It will be followed by a more detailed and instrumented investigation.

Equipment

Vent Hoods and Local Exhaust Systems. The equipment covered by the survey includes chemical hoods, tank vents, machinery and equipment vents, and any local exhaust system that would cause a harmful local environment to exist if the system fails. These exhaust systems are designed to protect a local area by removing the contaminant to another area and discharging a diluted mixture to atmosphere. A detailed analysis of the effect of the exhaust mixture on a general area is not done on most systems due to the small quantities of contaminants involved.

A study of vent hoods and local exhaust systems located at Langley Research Center was made on Contract NAS1-9127 by Richard I. Chamberlin and Associates. The report entitled "Industrial Hygiene Survey" resulted in a number of modifications being made.

All new vent hoods or local exhaust systems are being designed and installed in accordance with the recommended design standards of the American Conference of Governmental Industrial Hygienists. The standards give ambient air quality requirements, but no limit has been established on the total quantity to be discharged. In addition, all new chemical hoods or exhaust systems and the modifications to existing systems are reviewed by the Center's Subcommittee on Operations Safety or by the Design Review Panel to assure compliance with design standards.

Transportation Vehicles

Probable pollution of the atmosphere at Langley Research Center results from the use of various types of vehicles in the normal operation of the Center. A national survey indicates that approximately 99 percent of such vehicles used leaded gasoline. The categories and number of vehicles (based on a 24-hour day) are:

NASA employee's vehicles	3,200
Contractor employee's vehicles	1,356
Vehicles operated by contract based at LRC (taxis, etc.)	55
Commercial vehicles (delivery trucks, etc.)	400
Government-owned vehicles,	90

Effective measurement of the ambient air quality at LRC has not been made; however, a contract has been negotiated with Chamberlin Associates and such measurements will be made in the near future.

Noise

A few of the larger wind tunnels at the Center contribute to the noise environment. The fact that the Center is remote from residential areas alleviates the problem substantially insofar as community interaction is concerned. However, depending on atmospheric conditions, there have been in the past occasional complaints from individuals regarding tunnel operations.

Noise resulting from commercial aircraft operations has been recognized as a national problem. There is a critical need, in particular, to reduce the noise exposure to communities adjacent to airports. An Aircraft Noise Reduction Laboratory has been designed to help meet anticipated research requirements during the next decade. The proposed laboratory, construction to start in 1971, will permit orderly progress in the development of noise reduction technology by providing numerous capabilities that are lacking in current acoustic facilities. The design of quieter aircraft, for example, involves the interactions of physical acoustics and subjective responses with factors affecting aircraft performance. The laboratory, in addition to its advanced aircraft noise research capability, will also have facilities for research on space vehicle noise problems and noise problems associated with high-speed ground transportation vehicles.

2. The Probable Impact of the Langley Research Center on the Environment

Evaluating Langley Research Center operations using currently established standards indicates that there is no material impact on the environment. In 1969 the Virginia Peninsula Planning Commission distributed a report prepared by its consultant, Edwin Cox Associates, on the quality of air on the Lower Peninsula. Langley Research Center personnel cooperated fully with this survey, as noted in the report, and the fact that this laboratory was not considered as a significant contributor to air pollution in the community in any manner is reassuring. There has been no significant addition to the Center's plant in the period since the report. Heating plant emissions described are not noticeable beyond the immediate vicinity of the plant. There has been no quantitative increase in water pollutants, consisting for the most part of cooling tower chromates, as revealed by periodic sampling and analyzing of water taken at storm sewer outfalls. The effluent has been diluted by the normal water flow so that it is not a hazard when it reaches public waterways. Operation of the heating plant and the plating plant are controlled by established operating procedures which serve to reduce the possibility of unanticipated or unplanned release of pollutants in large quantities. Langley Research Center is not an industrial operation; there is no manufacturing done other than that required to support research activities. Completion of the environmental control program as proposed for the FY 73 C of F budget will eliminate localized pollution and place the Center in compliance with established standards.

Noise generated by wind tunnels is significant primarily to Center operating personnel as the distances from the tunnels to residential communities are sufficient to attenuate the noise to generally acceptable levels. The Langley Research Center Health Unit actively monitors working conditions to assure that protective gear is available and proper procedures are enforced to protect the hearing of Center employees.

The Space Radiation Effects Laboratory, located within the city limits of Newport News, is supplied with power by the Virginia Electric and Power Company. Sanitary sewerage disposal is by the Hampton Roads Sanitation District System. A weekly health physics survey is made to check contamination levels of air, water, and area radiation.

Langley Research Center scientists conduct investigations in an area adjacent to the town of Poquoson known as the Plum Tree Island Bombing Range which is owned by the Air Force. It is no longer used for bombing practice and Langley Research Center, by permission, is conducting model test over flights. The range is approximately 4,000 acres in size, largely marsh, with scattered hummocks of pine trees. It provides sufficient area for drop zone and recovery operations. Wildlife is unmolested by research activities and, in fact, is increasing. Current plans contemplate the area being declared excess by the Air Force and conveyed to the Fish and Wildlife Service, Department of Interior, as a conservation area. Langley Research Center personnel will continue to use the area under a permit issued by the Department of Interior. There is no known environmental impact

resulting from this activity and, in fact, due to Langley operations, an all-weather access road is maintained which will be of value to the Fish and Wildlife Service.

3. Probable Adverse Environmental Effects Which Cannot be Avoided Should the Operations be Continued

Langley Research Center operations will cause negligible degradation of the environment. There is a recognition of the critical importance of maintaining environmental quality and all practical means and measures are employed to prevent deterioration of the quality of air and water. The specific localized adverse effects of institutional facilities on the environment will be corrected by the control projects submitted for inclusion in the FY 73 budget. Specifically, the following improvements will be made:

(1) Improvement of cooling tower water treatment.

(2) Improvement of treatment and disposal of boiler blowdown waste.

(3) Installation of automatic chemical feeding system for cooling towers.

(4) Construction of a skimming basin.

(5) New ventilating system for the Metal Finishing Shop.

(6) Installation of natural gas burners in the heating plant.

(7) Stack modifications to the heating plant.

(8) Procurement of environmental monitoring equipment.

These improvements are proposed in response to Executive Order 11507.

In the use of pesticides, Langley operations are restricted to individual trees and shrubs outdoors and to building interiors. Pesticides employed are reported to NASA Headquarters on an annual basis and transmitted to the President's Cabinet Committee on the Environment, Working Group on Pesticides, for review and approval. Sensitive areas, such as the Cafeteria, are carefully controlled. The area mosquito control program is managed by the Air Force with overflights covering the Langley reservation and nearby communities. While no formal investigation has been made, all visual evidence indicates that indigenous wildlife has not suffered from any of these programs. There is every indication that wildlife population is increasing at the Center. For example, the Mallard duck population has doubled over the past 3 years. A trapping and removal program for Virginia Whitetailed deer was initiated because the deer herd has outgrown the limited range available on the reservation. Song birds are numerous and appear to be unaffected by Center operations.

Center project review procedures seek to anticipate and identify very early in the planning process, possible unfavorable environmental burdens. Project approval is contingent on the resolution of environmental effects which exceed established standards. The effect of the cumulative totals of a number of entities has been recognized by the appointment of a special working group which maintains surveillance of the environmental program at Langley Research Center, with broad, discretionary power to make beneficial changes.

4. Alternatives to the Current Action

Langley Research Center has been in existence for over a half century. The value of land and facilities is in excess of $250 million. The criteria used to select this site, viz., the temperature, the number of flying days per year, character of the land, accessibility to population centers, etc., continue to be valid reasons for retaining this Center in its present location. Langley operations have a minimal effect on the ecological regime. It would remain substantially the same regardless of its location.

5. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Langley Research Center is unique in that it is possible to assess the effect on environment from the perspective of use by nearly two generations. Land usage has changed; what was once farm land and scrub forest is now occupied by buildings, streets, and large lawn areas. Some marsh has disappeared, both from fill operations and from a change in the character of the streams which have been altered by community development. The Center population reached a peak of 4,200 in 1968 and is now on the decline. The basic quality of the environment has been less affected by Center operations and growth than by the expansion of population, industry, and traffic in the adjoining communities not associated with this Center. No retrogression has occurred - in fact, improvements have been made in the ability of the land to produce

vegetation, wildlife, or food. The land has not been rendered useless by waste deposits, poisoning, or other forms of destruction. The same is true in respect to the surrounding waters. The methods used to control pollution at this Center have been described in other sections of this report. There is no intention on the part of Langley management to permit any degradation of the environment.

6. Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Continuation of Langley Research Center

The environmental commitment at Langley Research Center is in the use of the land on which to construct facilities and the servicing utilities required. No streams have been dammed, no underground silos constructed, and no residue of contamination created to leach out of the soil. There has been no consumption of irreplaceable natural site resources. It can, therefore, be stated that environmental commitments at Langley Research Center are both retrievable and reversible in direct proportion to occupancy of the area.

7. Coordination With Federal, State, and Local Agencies

(a) The initial draft of this environmental impact statement was published in the Federal Register and also reviewed by representatives of the Council for Environmental Quality and the Environmental Protection Agency. Comment was received from CEQ as follows: " . . . it does not have the summary or specific statement addressed to the five environmental impact statement points which it would require. The material

provided, however, is sufficiently comprehensive that it could be pulled together in a summary or conclusion section, leaving the present data as is."

As a result of this comment, the statement has been reorganized to conform to the CEQ guidelines dated April 23, 1971, and the National Environmental Policy Act of 1969, P.L. 91-190, January 1, 1970. Appendix B, Source Inventory, has been amended by the addition of the proposed Aircraft Noise Reduction Laboratory.

(b) As part of our policy of community cooperation, Center personnel have made contact with a number of local, State, and Federal instrumentalities and also local industrial firms concerned with environmental protection, and working relationships have been developed. Meetings have reviewed areas of mutual interest and possible ways in which the Langley Research Center can contribute effectively to environmental control in the community. These groups include the Virginia Peninsula Regional Planning Commission, the York County Board of Supervisors, the Virginia State Air Pollution Control Board, the Virginia State Water Control Board, the Office of the Governor of Virginia, the Virginia Institute of Marine Science, the Virginia Electric and Power Corporation, and the Air Pollution Control Office of the Environmental Protection Agency.

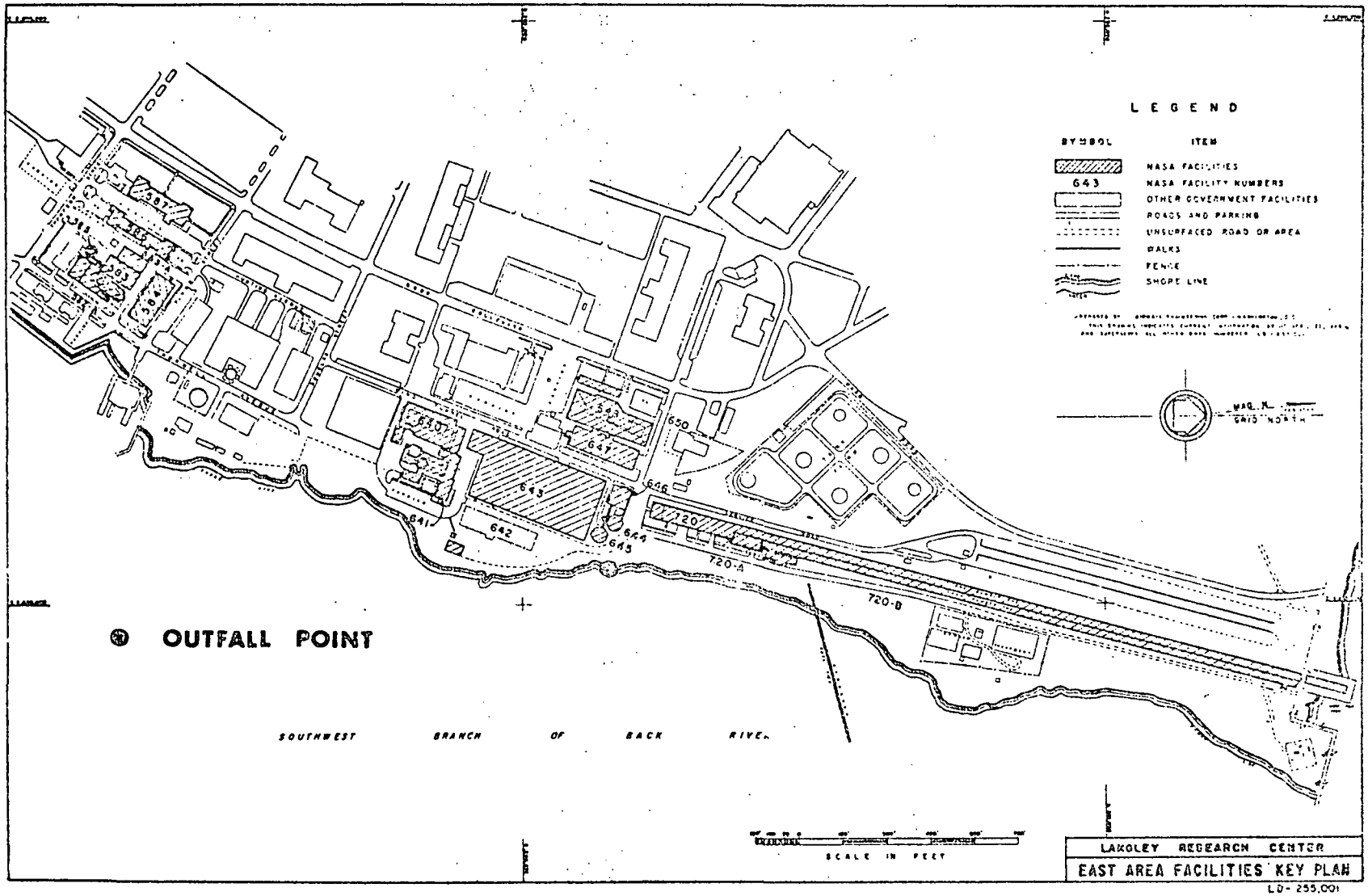
Langley recently sponsored a seminar series for Center personnel in which nationally recognized authorities on environmental problems were invited to visit the Center.

APPENDIX A

SITE MAPS

ENCLOSURE 1

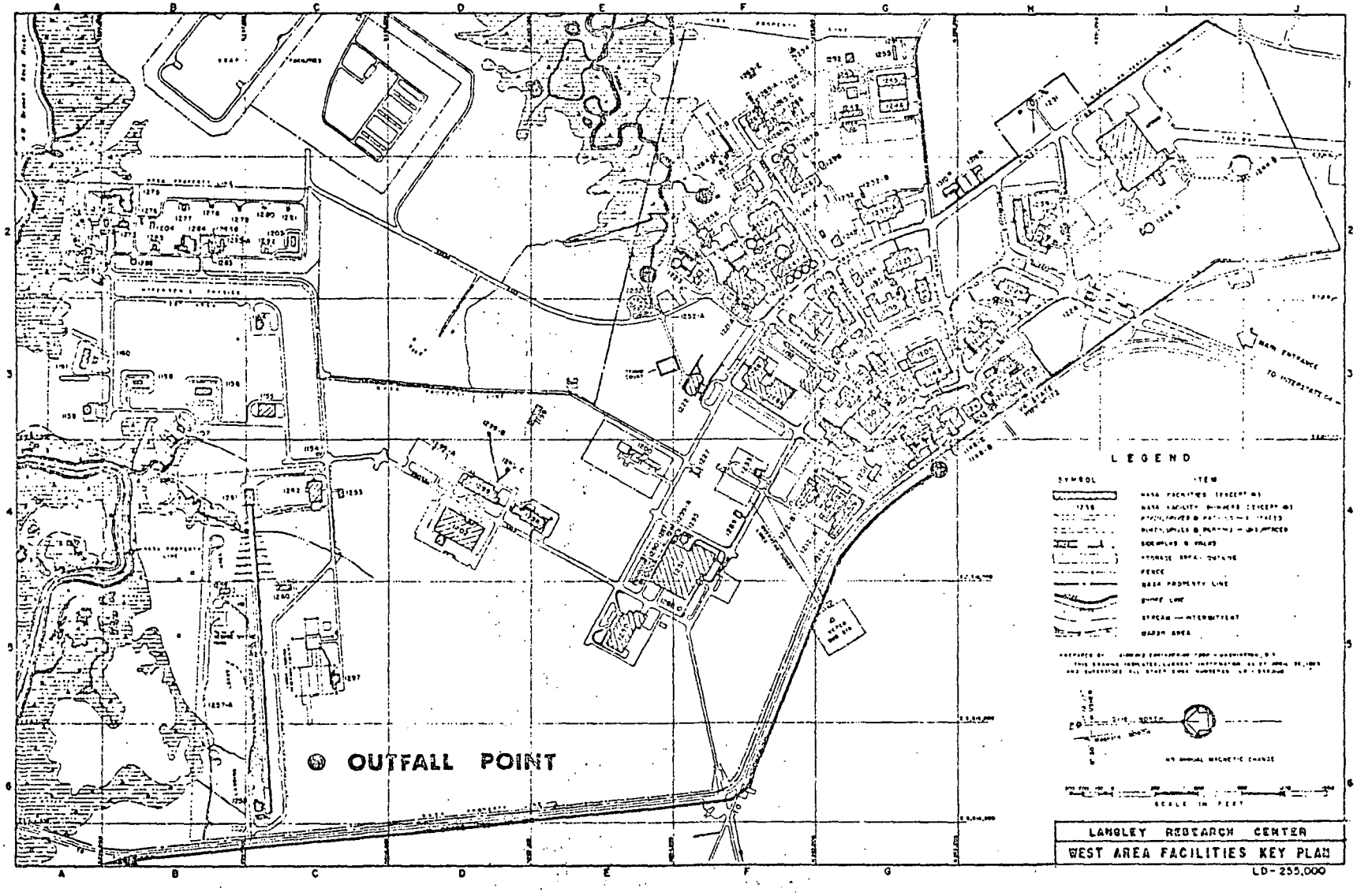
STORM DRAINAGE SYSTEM
EAST AREA OUTFALL DATA POINT



ENCLOSURE 2

STORM DRAINAGE SYSTEM

WEST AREA OUTFALL DATA POINTS



APPENDIX B

SOURCE INVENTORY

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contamination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
8 ft tunnel (640)	Aerodynamics research testing	Intermittent	None	None	Minor	Research operations	None		Through vent valves	Cooling tower cooling	None
Low press, turbulence tunnel, TBD, 6x19 transonic (642, 83)	Aerodynamics research testing	Intermittent with high frequency short duration tests	None	None	Considerable	Research operations	None	Cooling tower water cooling	Blowdown through test sec.	Cooling tower cooling	None
Full scale tunnel (643)	Lowspeed aerodynamics research testing	Intermittent	None	None	Minor-mostly aerodynamic noise	Research	None	Cooling tower water cooling	Atmospheric stagnation	Cooling tower cooling	Tunnel-wall insulation
12-foot low speed tunnel (644)	(Tentatively shutdown)										
20-foot vertical spin tunnel (645)	Vertical spin testing	Intermittent	None	None	Some	Research operations	None	Cooling tower water cooling	Atmospheric stagnation	Cooling tower cooling	Relies on insulation from tunnel structure.
Transonic dynamics tunnel (19 ft) (648)	Up to 1.2 Mach testing	Frequently almost a continuous operation (two shifts)	Freon leaks from tunnel about 0.1 of of 1 percent	None	Noise from pumps that evacuate tunnel and test section and also tunnel running--both external and internal noise	Research operations		Cooling tower water cooling	Discharging air from vacuum pumps	Cooling tower	Survey was made and some mods to bldg. to alleviate
Impacting structures facility (720B)	Shock load testing	Intermittent	None	None	None						
16-foot transonic tunnel (1146)	Aerodynamic testing	Fairly frequent sometimes by 3-shift testing	H_2O_2 discharge sometimes	None	Noise from compressors, motors, and tunnel noise hi-intensity noise at boundary-layer intake	Research operations	Every 6 months employees of tunnel get ear check	Cooling tower water	Closed-circuit tunnel	Cooling tower	None has been proposed
LRRL	Nuclear Particle Accelerator Laboratory	24 hours/day, 7 day/week	Radioactivity; no chemicals	Radioactivity; Chemicals (Chromates, H_2SO_4, and NaOH)	None	Health Physics Section and Technical Services Division	Retention Tanks for Radiation wastes; Settling pit chem. dilution	None for Radioactivity; H_2SO_4 and NaOH mixed to give pH ~7	Air-Conditioning Sys. Output	City Sanitary Sys. and Surface water drainage (chromates only)	Not Applicable

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contamination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
Structures research (1148)	Temperatures, environmental tests of aerospace and aerodynamic materials	Continuous 8 hours a day	Mostly exhausts from vacuum pumps using silicone-type oils. Also considerable liquid N_2 boiloff	None	Minor and confined to one arc set using nitrogen	Research operations	None	Cooling tower and exhaust silencers on pumps	Pump and arc jet exhausts ducted outside as well as nitrogen exhaust	Cooling tower	None
Chemical magazine* (1155)	Storage	Continuous	Some if containers burst	If containers burst	None	Research operations	Eye wash sprays and showers-vent system	None	Building vents	None except emergency	None
Hydrazene magazine* (1156)	Storage	Continuous	Some if containers burst	If there is a rupture	None	Research operations	Leak detection device and recorders, eye wash and showers	None	Building vents	Sumps under bldgs with drain to distant catch basin and drain to creek after treatment	
Hydrogen peroxide magazine* (1157)	Storage	Continuous	If containers burst could have flame hazard	If there is a rupture	None	Research operations	Leak detection device and recorders, eye wash and showers	None	Building vents	In event of temperature rise there is a heat detection device that actuates water spray to cool tanks	
Rocket magazine (1158)	Storage	Continuous	None	None	None	Research operations	None	None	Building vents	None	None
Rocket assy bldg (1159)	Storage	Continuous	In event of mishandling and spillage	Low	None	Research operations	None	None	Building vents	None	None
Rocket test control bldg (1160)	Rocket testing		None	None	None	Research operations	None	None	None	None	None

*Eye wash and showers.

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contemination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
1161 rocket test cells	Rocket motor testing	Intermittent	Chemical discharge from rocket motors	If personnel desire they could dump chemicals	Small rocket motor exhaust	Research operations	Only what may be written in operational proced.	None	From rocket motors	None	None
1164 nitrogen tetroxide magazine	Storage	Continuous	In event of leaks there are vapors		None		None	Can treat H_2O_2	Vaporine	Can dump into sump under tank and drain from this sump to a distant catch basin for treating	
Hot gas radiation research facility Building 1200	Hi-temperature aero space research	(not yet operational)	H_2 discharge to vac. sphere 2nd	None	Very small short duration	Research operations	None except operation procedures	None	Dilute H_2 with steam from ejector when evacuating sphere	None	None
Micrometeroid impact simulator Building 1201											
Flight instrum. research laboratory Building 1202	Instrument research	Continuous	None	None	None	Research	None	None	None	None	None
Chemical storage HPTA Building 1203	Storage	Continuous	Little	None	None	Research technical operation	None	None	Vent from building	None	None
Pyrotechnic research laboratory Building 1204	Pyrotechnic research	Continuous	Very small since most of the testing is on a very small scale mostly using solid propellants	None	None	Research	Operational procedures	None	Vents from building and closed chambers	None	None
Fatigue research laboratory Building 1205	Materials research and testing	Continuous	None	None	None	Research operations	None	None	None	None	None
7 x 10 tunnel (high speed) Building 1212B	Aerodynamic research testing	Intermittent	None-closed loop	None	Noise from compressor operation and aerodynamic noise	Research operations	None	None	Vent as necessary	None	None

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contamination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
VSTOL Building 1212C	Aerodynamic research testing	(Not yet operational)									
Anechoic noise facility Building 1216A High intencity noise facility Building 1221 Low frequency noise facility Building 1221A	Aircraft and motor noise testing	Intermittent	Discharge from lube oil vents may put out vapors	Small L.O. cooling water is dumped to sewer and if there were a leak oil could be put into sewer	Small only very infrequently does noise level go above 95 db in area of adjacent buildings	Research operations	Operational technique	None	——	——	——
11" tunnel Building 1229	Pressure tests, heat transfer studies and force testing with air and helium M-6-M-18 range	Intermittent	Discharge fumes from vacuum pump oil is fairly bad uses air and helium	None	Low	Research operations	None	Personnel are looking into demister for vacuum pumps	——	——	——
Instrument Research Laboratory Bldg. 1230	General instrumentation electronic and measurement research	Continuous	Vacuum pump discharge	None	None	Research operations	None	None	Hoods with exhaust fans to atmosphere	-----	-----
Bldg. 1232 CMG Lab	Spacecraft control research	Intermittent	None	None	None	Research Operations	-----	-----	-----	-----	-----
Bldg. 1236	Space vacuum lab	Intermittent	Vacuum pump discharge	None	None	Research operations	None	None	Vent from pumps	Cooling tower	
Bldg. 1293	Chemistry laboratory	Continuous	Chemical fumes and vapors	Dumping chemicals into soil	None	Research operations	None	None	Vent to atmosphere through fume hoods	Drains to sewer and cooling tower recirculation	-----
	Attitude control simulator	Intermittent	Discharge fumes from vacuum system pumps	None	Exhaust noise from vacuum pumps	Research operations	Electrostatic oil mist eliminator in vacuum pump exhaust	None	Through vent duct to atmosphere	Cooling tower recirculation	Mufflers were added to roots blower exhaust
	55 ft. vac. cylinder DRL	Continuous			Vibration equipment		None				

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contamination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
Hypersonic Physics Test Area	Miscellaneous facilities for pyrotechnics research and high-speed aerodynamics research	Continuous	Vacuum pump discharge, rocket motor propellant fumes, chemical fumes from propellant mixing. Also, there is heating boiler for supplying heat to test area buildings	Dumping of unexpended rocket propellants and oxidizers in swamp	Noise from rocket firing	Technical research personnel	Only through approved operational procedure	Some vacuum pumps may have mist eliminations	Direct to air	Cooling towers and directly to sewer or swamp	None
Pebble Heater Bldg. 1263	Hypersonic aerodynamics research to M-6	Intermittent	Discharge to air of dust from zirconia pebbles when operating blow-down. Fired by air, O_2, and propane. Air and H_2 are through pebble bed	None	Has high intensity noise level in about 300-yard radius	Technical research personnel	None	None	Air and nitrogen discharge to atmosphere through nozzle	City drains	None
Jet Exit Test Facility Bldg. 1274	Jet exit tests 90 percent air 10 percent H_2O_2	Just getting into operation; will run several times daily for 10-min periods	H_2O_2 discharge to air	When transfer from H_2O_2 to air operation, there is some H_2O_2 spillage. Deluged with water into sewers	This is a high noise level facility, however the noise is local to the facility	Research operations	Fence has been erected behind jet exit to cut noise to 1201. Have measured 75 dB at 1201 after they complained	Water deluge to dilute H_2O_2 spills	Direct	Direct to sewer when necessary	Fence behind jet
4 x 4 Supersonic Tunnel Bldg. 1236	Force, moment, and pressure studies for aerodynamics: M 1.25 - M 2.6	Intermittent	None	None	Some noise, fairly low intensity	Research operations	None	None	Closed loop	Cooling tower	None except what abatement the tunnel shell itself offers
Propeller Test Stand Bldg. 1242					(Inactive at present)						
Bldg. 1244, Hangar	Aircraft storage, work area, and flight test	Continuous	Aircraft exhaust	Possible spillage of oil and/or gasoline into sewer, but unlikely	Aircraft I.C. engine and jet engine noise	Research operations	Personnel makes certain waste oil is properly disposed of	None	Direct	-----	None

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contamination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
20 Hypersonic Tunnel M = 6 M = 8.5 Bldg. 1247D	Heat transfer, pressure, and force testing	Frequently	None	None	This facility with the air ejector generates a high noise level of 100-110 dB	Research operation	Periodic checks of dB level in and about 1247 complex	Some work has been done to alleviate the noise by turning discharge all up, but this was little help	Direct	Cooling tower	Rearranging piping and lining rooms with insulation
Hypersonic Nitrogen Tunnel Bldg. 1247A	Heat transfer studies	Intermittent	None	None	None	Research operations	None	None	None	None	None
Mach 8 Variable Density Tunnel Bldg. 1247D	Fundamental aerodynamic and fluid dynamic investigation using air	Intermittent	Pollution from vacuum pumps that evacuate sphere	None	Some noise when discharging to atmosphere	Research operations	None	None	Directly through diffuser	Cooling tower	None
22-Inch Helium Tunnel Bldg. 1247B	Heat transfer testing	Intermittent	None. Helium is sealed in system and recirculated. Some contamination from vacuum pump exhaust	None	None	Research operation	None	None			
4-Foot Hypersonic Aerothermal Facility					(Not operational)						
Pilot Model Expansion Tube Bldg. 1247G	Studies of expansion tube flows in air	Intermittent	Uses H_2 gas	None	None	Research operation	None	None	Direct to air or into a dump tank	None	None
Hypersonic Continuous Flow Facility Bldg. 1251	Heat transfer and aerodynamic tests	Intermittent	Uses air in closed circuit. 4-750 FM vacuum pumps exhaust vacuum pump oil vapors	None	Noise only inside building in equipment area	Research operation	None	Vacuum pumps have electrostatic mist eliminators	Vacuum pumps evacuate sphere	None	None
Unitary Bldg. 1251	High-speed aerodynamics tests	Intermittent	Air only	None	Aerodynamic and equipment noise	Research operation	None	None	Closed-loop air	None	None

Facility	Operation	Frequency	Potential air contamination	Potential water contamination	Potential noise contamination	Control group	Control technique	Treatment process	Means for discharge to atmosphere	Means for discharge of liquid	Method of noise abatement
9 × 6 Tunnel Bldg. 1256	Aerodynamic heating studies	Intermittent and frequent	Uses air, and air/gas combustion products	None	The run duration is short, seldom more than once a day, but very intense	Research operation.	None	None	Direct	Cooling tower	None
8-Foot High Temperature Structures Tunnel Bldg. 1265	Hypersonic flight thermal studies	Intermittent	Exhaust gases from tunnel are high-temperature hydrocarbon fuel, gas, air, and oxygen. Nitrogen is used for purge gas	Only if hydrocarbon gas is extrained in swamp	High intensity noise for short duration (1-3 min)	Research operation	None	None	Direct	Cooling tower	None
Arc Jets A, B, C, and D Bldg. 1267	Ablation tests	Frequent usage	Materials ablated from test models in arc stream are those which can break down into various hydrocarbon compounds and are released to atmosphere	None, unless ablative residue settles in water, but this quantity is small	Noise from steam ejectors within 50 ft of ejector.	Research operation	None	None	Direct	Cooling tower	None
Lunar Landing Bldg. 1697	Test bed for planetary vehicle landings	Intermittent	None	None	None	Research operation	None	None	-----	-----	-----
Landing Loads Bldg. 1256	Research on aircraft landing loads	Intermittent	None	None	None	Research operation	None	None	-----	-----	-----
41-Foot and 60-Foot Vacuum Sphere Bldg. 1295 Bldg. 1251	Space research	Intermittent	Exhaust from vacuum pumps	None	Noise from vacuum pumps in Bldg. 1251	Fabrication Division	None	None	Vacuum pump exhaust discharged through electrostatic oil eliminators	-----	-----
Aircraft Noise Res. Lab. Bldg. 1208 (Construction 1971)	Noise Research	Intermittent	None	Chromates NA_3PO_4 & NA_2CrO_4	Facility designed to minimize noise	Research operation	None	None	Direct	Cooling tower	Silencers & insulation